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                                                          12/01/2006

Re: Proposal # 0025 - Quantitative indicators and life history implications of environmental stress on sturgeon

To Whom It May Concern:

We are pleased that our proposal received enthusiastic reviews and was again recommended for funding. A previous version of this project had already been recommended for funding within the 2004 Science PSP but funding did not materialize as CALFED funds allocated to the 2004 Science PSP were cut in 2005. We hope that the funding recommendation will result in final approval of this important project.

We appreciate the input and suggestions from the reviewers of our proposal and the Technical Panel. The conditions outlined for funding this proposal are straight-forward and can be met, although we still think that purchasing an Ultraflex mass spectrometer with funds from this project would have entailed significant benefits for future state projects. In what follows we address each condition of the TSP Panel for funding this proposal and some additional suggestions of the reviewers.

Conditions:

1. As suggested in the Technical Panel Review, instead of purchasing a mass spectrometer we will use an existing mass spectrometer that is suitable for this work. Renting this model of mass spectrometer is not an available option. The recharge cost for existing mass spectrometers and the cost of preparation/ transport of samples will be covered by adjusting our proposed budget within the recommended total funding amount of $700,000.

2. It was stated as critical that all components of the project will involve both white and green sturgeon. We have adjusted the proposal to clarify that we will use both species (green and white sturgeon) in all components of this project. Growth and maturity of our green sturgeon broodstock is evaluated annually. During the last annual sampling on November 13, 2006 we identified 6 gravid females (mean weight 31.3 kg, average gain 8.9 kg for last year, egg diameter 3.3 mm – very close to fully grown egg size) which we plan to spawn in spring 2007. We also identified at least 4

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maturing (vitellogenic) females for the spawning in 2008. Eight to ten ripe males are available for spawning each year. At this stage of maturity of our green sturgeon females we expect to produce, during spring spawning seasons, the required number of offspring for the project. In addition, we have a sufficient number of green sturgeon juveniles from previous spawnings at our Center for Aquatic Biology and Aquaculture (CABA) to be able to conduct the proposed experiments.

3. In response to the third condition stated in the Technical Panel Review we have added a component to quantitatively link physiological/ biochemical effects and tissue Se burden of wild fish to consider population level effects. As correctly emphasized in the Technical Panel Review, a major purpose of our project will be to "provide building blocks for this sort of synthesis in the future". We will start combining the building blocks generated by this project with existing data to generate a model incorporating our data into an overall population/ community-level context with the help of an experienced modeler (Prof. Ted Foin, Department of Plant Sciences, UC Davis). A support letter from Prof. Foin is attached. We will incorporate data sets that already exist for the San Francisco Bay-Delta water system regarding the environmental stresses under study into this modeling effort. Specifically, we will compare thresholds of induction of newly identified biomarkers in response to salinity, temperature, Se, and Hg stresses/ stress combinations with available datasets on these environmental parameters in the San Francisco Bay-Delta water system. Furthermore, we will correlate the stress response of newly identified biomarkers in laboratory acclimation experiments with the state of such biomarkers and tissue selenium burden in biopsies of field sturgeon (Task 5). Data sets generated by existing monitoring programs that will be used include:

- CDFG adult population study (date, location, species, length, CPUE, estimated abundance, harvest rate, survival rate)
- CDFG creel data (date, location, catch, effort, length, sturgeon species not differentiated)
- CDFG Bay Study Otter trawl (date, location, species, length, CPUE)
- CDFG 20-mm study (date, location, species, length, CPUE)
- CDFG juvenile sturgeon sampling program (date, location, species, length, CPUE)
- DWR and USBR fish facility salvage data (maintaind by CDFG; date, location, species, length, density, estimated total salvage)
- Glenn-Colusa Irrigation District fyke and rotary-screw traps (date, location, catch, effort, length, sturgeon species not differentiated)
- USBR Red Bluff Diversion Dam screw-trap (date, location, catch, effort, length, sturgeon species not differentiated)
- USGS Water Data for California (http://waterdata.usgs.gov/ca/nwis/nwis)
- Bay Delta and Tributaries (CEDEN) Project (http://www.bdat.ca.gov)
- California State Water Resources Control Board Water Quality TSM Database (http://www.waterboards.ca.gov/programs/smw/index.html)

The budget is not impacted by adding this component because we had already planned to analyze our data comprehensively once they have been collected and we should have emphasized this more succinctly in the proposal. The collaboration with Prof. Foin will not require any additional funds.

Finally, because of the seasonality of spawning in both white and green sturgeon and the importance of utilizing our mature green sturgeon (at the latest in early spring) we kindly request the earliest possible award of funds for this project.

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Additional comments:

An additional point that was criticized by one reviewer is that there may be insufficient treatment combinations to comprehensively examine the effects of combinations of stressors. We agree that ideally every possible combination of stressors should be included in our experimental design. However, to maintain feasibility and focus we were selective in the combinations of treatments that we propose. Some combinations are not biologically relevant, for instance sturgeon larvae do not tolerate substantial increases in salinity below a certain age (Dr. Peter Allen's PhD thesis, UC Davis, 2005, prepared in Prof. Cech's and Kueltz's laboratories). Other combinations are less likely to occur in the field than others and we have made an effort to focus on those that we deem most relevant. However, we will incorporate the suggested changes in the experimental design of Task 3. In response to a reviewer's suggestion we have expanded task 3a and task 3b to include exposures to methyl-mercury (MeHg) alone and to look at a range of selenomethionine (SeMet: 200, 400, 800 mg/kg body weight) and a range of MeHg (20, 40, 80 mg/ kg body weight). These additional treatments will require some extra effort and supplies for tasks 3 and 6 but we will cover those by adjusting our proposed budget within the recommended total funding amount of $700,000.

This project represents a start in using modern proteomics technology with a clear objective for an ecophysiologically highly relevant problem in the San Francisco Bay-Delta water system. Therefore we carefully constructed an experimental design that guarantees the feasibility of all proposed tasks in the context of the available time and resources. We are certain that this project will provide major baseline data for further expansion of this research direction, not just for ourselves but also for other investigators.

We fully agree with the reviewer that more comprehensive statistics may be required for analyzing the extensive datasets generated and integrated in this project. Because the choice of appropriate statistical tests depends very much on the raw data we have limited speculation about this part in our proposal. However, we will consult with an experienced statistician, Prof. Neil Willits (Department of Statistics, UC Davis), to apply the most appropriate statistical analysis to our data. A letter indicating Prof. Willits willingness to support us in this regard is attached.

In summary, we thank CALFED for recommending our proposal for funding. Having addressed the conditions outlined in the Technical Review Panel Summary Report, we look forward to start working on this exciting project as soon as possible.

Yours truly,

Dietmar Kueltz
Associate Professor
Department of Animal Science, UC Davis

(representative for all Co-PIs on this proposal)